

## Response to Deines and Williams on Astronomical Timescales

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### Abstract

In a paper presented at this conference, Deines and Williams (DW) question the conventional determination and interpretation of the differences between astronomical timescales, such as Universal Time (UT) which deals with Earth rotation, Atomic Time (AT), and planetary ephemeride timescales such as Terrestrial Time (TT). This paper offers explanations attempting to remove some sources of confusion on the subject, in particular:

- 1) To explain large discrepancies in the determined values for the tidal deceleration of Earth spin rate, we show that the rotational acceleration producing decadal variations in Earth spin are large compared to the tidal deceleration and easily mask the latter signal in rotation data spanning less than 200 years.
- 2) DW argue that the absence of a leap second between 1999 Jan 1 and 2005 Dec 31 is a statistically improbable event and is an artifact of the UT formula redefinition adopted in 2003. We offer a counterexample. If the Terrestrial Time second had been defined to match the UT second at an epoch other than the effective 1819 epoch that was used, a seven year span without leap seconds can be produced in other decades, decades without a redefinition of the UT formula. This shows that several seven year spans without leap seconds are possible and thereby negates the DW statistical argument.
- 3) DW also argue that there is a divergence in the TT timescale because relativistic time dilation was not included in Newcomb's analysis of the Sun's apparent motion. We show by a simple analysis that any such dilation was absorbed into the observationally determined elements of Earth's solar orbit. The resulting theory then accurately predicts the Sun's position using TT as told by Earth mounted clocks without any explicit use of time dilation, that is, there is no observational indication of timescale divergence.